

DATALOGGER DATA VIEWER

USER GUIDE

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DATALOGGER DATA VIEWER USER GUIDE

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1 Introduction

The Datalogger Data Viewer (Data Viewer) is a Microsoft Access application that is used to manage and analyze program-specific continuous data from the Lummi Nation, the Nooksack Indian Tribe, or from various US/State agencies. The data that can be accessed by the viewer is stored in three separate access 'table' files (backends) that share identical table structures and relationships. There is one table file for data collected by Lummi, one for data collected by Nooksack, and the third is for data collected by US or State agencies. The intention is that Lummi and Nooksack will manage their own data using the viewer, and share their respective table files annually. The third table file is provided in case either tribe wishes to use the data viewer tools with data sourced from non-tribal agencies and there is no expectation of sharing the third-party tables file.

The purpose of this document is to guide users of the Datalogger Data Viewer through the various steps of importing, exporting, summarizing, and analyzing continuous data collected using data loggers

Any questions or issues not addressed by this document may be referred to Craig Dolphin at Lummi Natural Resources (360 384-2387), or Jeremy Freimund at Lummi Water Resources (360 384-2212).

2 User Interface

The Data Viewer uses a combination of Access database forms and Visual Basic for Applications (VBA) code to enable database users to manage and analyze continuously recorded environmental data.

2.1 Select Data Source

The *Select Data Source* form (Figure 2.1) is activated during startup of the data viewer. This form is the central hub for the user interface and permits the user to select which dataset they wish to work with.

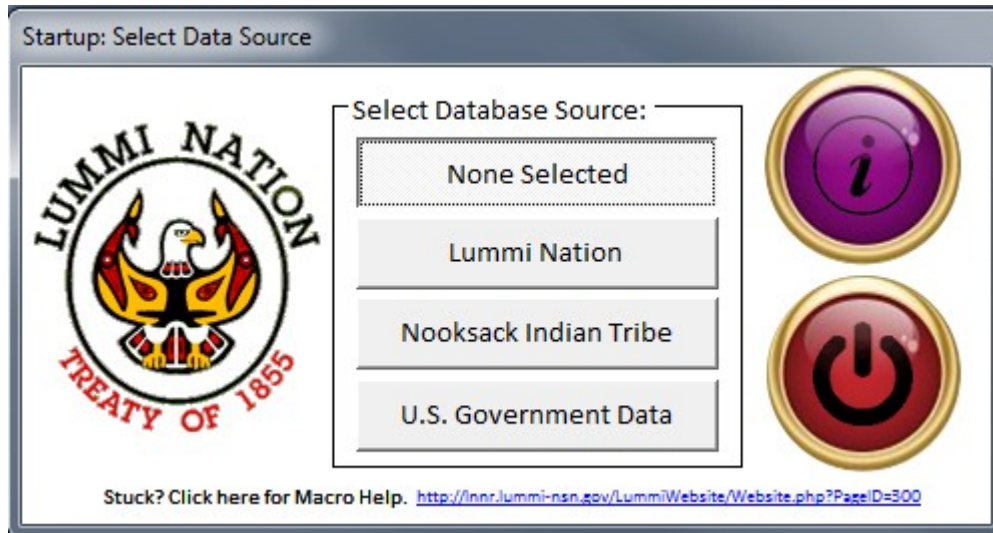


Figure 2.1. The *Select Data Source* form opens automatically when the Data Viewer is opened

Once the user has selected the desired data source, the *Select Data Source* form should close and the *Main Menu* should open.

If the user selects a data source and the form does not automatically close then it is likely that the Macro settings for the database are preventing visual basic code from executing. Complete instructions for resolving the macro settings issue can be accessed by clicking on the blue link text at the bottom of the form.

To contact the database viewer developer in the event of bugs, the user can click on the purple 'information' button to find relevant contact information. To quit the data viewer the user can click the red power button.

2.2 Main Menu

Once the user has selected a data source, the Main Menu form will open.

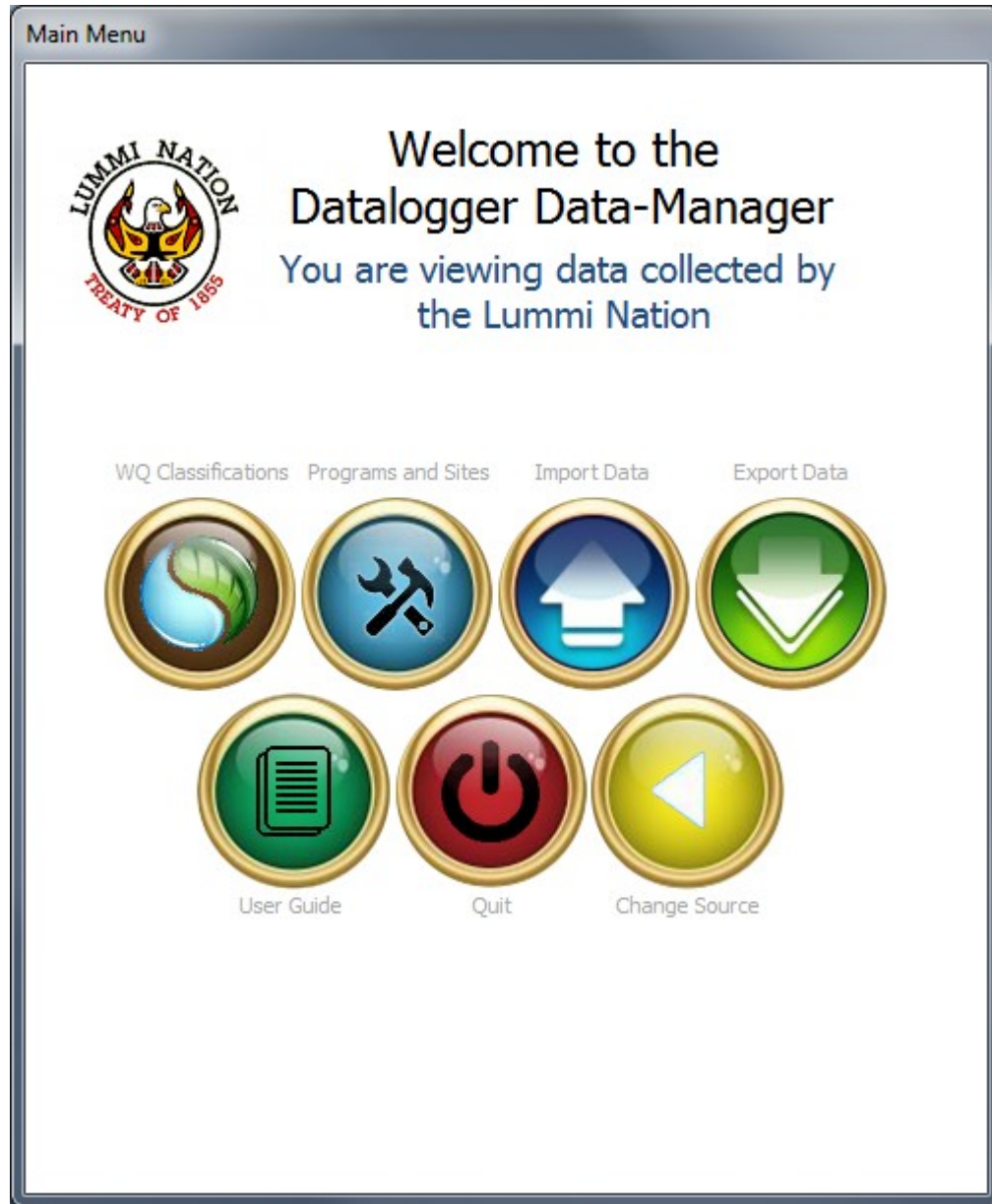


Figure 2.2 The *Main Menu* form

From the Main Menu the user can elect to setup/edit water quality classifications, setup/view programs and site information, import a new dataset, export raw/summary data from the database, view this user guide, quit the database, or return to the *Select Data Source* form.

2.3 Setup Water Quality Classifications

When the user clicks on the WQ classifications button the Water Quality Classification form will open (Figure 2.3). This form shows the various classifications for water quality that can be used to classify sampling sites. Note that a site can only be assigned one water quality classification.

The screenshot shows a software window titled "fmWQClass". Inside, there is a label "Water Quality Class:" followed by a dropdown menu currently displaying "Lummi Marinewater AA". Below this is a section titled "Control Limits for this WQ Class" which contains a table. The table has two columns: "Control Limit Name:" and "Control Limit Value:". The first row shows "1-day maximum temperature" in the name column and "13" in the value column. There is a second empty row in the table. To the left of the table, there are icons: a green circle with a white plus sign, a blue square with a white right-pointing triangle, and a blue square with a white asterisk. At the bottom of the form are two large circular buttons: a green one with a black plus sign and a red one with a white left-pointing triangle.

Control Limit Name:	Control Limit Value:
1-day maximum temperature	13

Figure 2.3 The *Water Quality Classification* Form

To navigate to different water quality classes the user should select the desired class from the drop down list at the top of the form (Figure 2.4).

The screenshot shows the 'fmWQClass' application window. At the top, there is a label 'Water Quality Class:' followed by a dropdown menu currently displaying 'Marine - Class AA (Extraordinary)'. A context menu is open, showing the following options: 'Lummi Marinewater AA', 'Marine - Class AA (Extraordinary)' (highlighted), 'Non Classified', 'Ephemeral Class AA', and 'Lummi Freshwater AA'. Below the dropdown, there is a section titled 'Control Limits for' with a green plus icon and a 'Control' button. To the left of this section is a '7DADM Limit' label and a '*' icon. Below these are two large circular buttons: a green one with a black plus sign and a red one with a white left-pointing triangle.

Figure 2.4 Selecting a different WQ classification from the drop down list

To add a new water quality classification to the database, the user can click on the large green '+' button at the bottom of the form. This will open the form to a new (blank) record and the user must then provide a new class name in the top field of the form. There is currently no mechanism for deleting WQ classifications once they have been created.

For each WQ classification, the user can also optionally choose to add one or more regulatory water quality control limits that are applicable to the sites that belong to the classification.

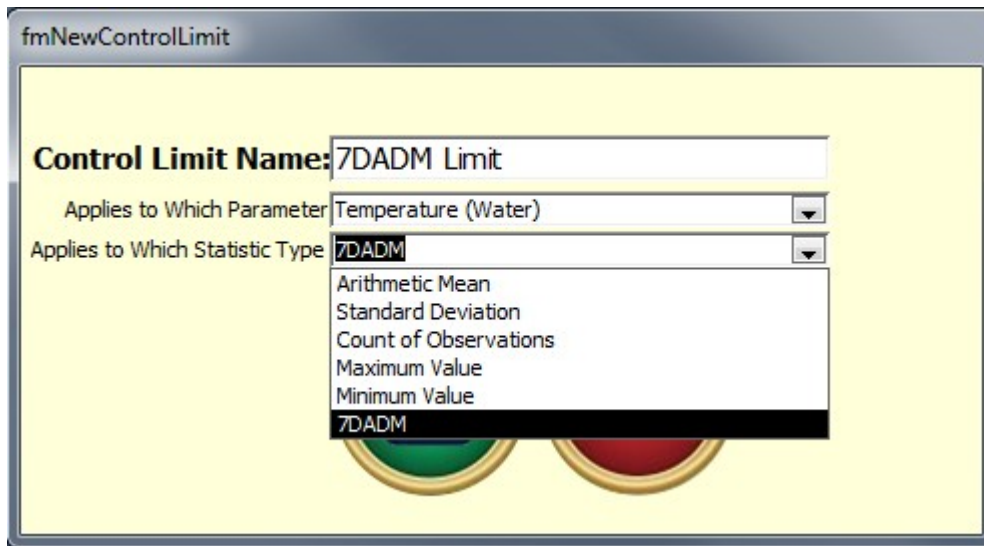
To define a new control limit and value for a WQ classification the user should select the relevant control limit name from the drop down list, and specify the control limit value to use. To delete a control limit and value from a water quality classification, the user should select the row that they wish to delete by left-clicking on the grey row-selector to the left of the control limit name drop down. The selector should turn black to indicate that the row is selected. Once the row is selected, the user can press the delete button on their keyboard, and confirm the delete when prompted, to delete the control limit from the water quality classification. There is currently no mechanism for deleting control limit names/types from the drop down list.

To view information about existing control limit types/names, the user should click on the white information button next to the selected 'Control Limit Name' field to open the *Control Limit Details* form (Figure 2.5). To add a new type of control limit to the database the user should click on the small green '+' button adjacent to the text of the control limit name label on the *Water Quality Classifications* form.



Figure 2.5 The *Control Limit Details* form

In addition to the name of the control limit type, each control limit created in the data viewer must specify the parameter and the summary statistic (Figure 2.6) that the control limit should be applied to.



The screenshot shows a software window titled "fmNewControlLimit". Inside, there is a form with a yellow background. The first field is "Control Limit Name:" with the text "7DADM Limit" entered. Below this are two dropdown menus. The first dropdown is labeled "Applies to Which Parameter:" and has "Temperature (Water)" selected. The second dropdown is labeled "Applies to Which Statistic Type:" and has "7DADM" selected. A list of options is visible for the second dropdown: "Arithmetic Mean", "Standard Deviation", "Count of Observations", "Maximum Value", "Minimum Value", and "7DADM". At the bottom of the form, there are two circular buttons: a green one on the left and a red one on the right.

Figure 2.6 Specifying the summary statistic for a control limit

Once the control limit details have been fully described, the user can click the green save button to save and close the *Control Limit Details* form. If the user has created a new control limit then it should now appear as a selectable item in the 'Control Limit Name' drop down list on the *Water Quality Classifications* form.

Once the Water Quality classifications and control limits have been setup, the user can return to the *Main Menu* by clicking on the red and white back arrow button.

2.4 Setup Programs and Sites

Before any data can be imported, programs and site details need to be defined for the database to ensure that data can be tracked at the requisite level. The data in the database is arranged first by tribe, then by organization (within tribe), then by program within organization, and finally by site.

Programs and Sites Setup

Organization: Lummi Water Resources

Datalogger Names/Serial#	Programs
▶ 101023423-A	▶ Ambient Water Quality Monitoring Program
*	▶ Spill Response Program
	*

Ambient Water Quality Monitoring Program

General Program Notes:

Program Sites +

Program QAPPS +

QAPP Version	Effective Date		
3.0	1/1/2006	i	
4.0	3/1/2010	i	

Figure 2.7 The *Programs and Sites Setup* form

By default the form will open to the first organization in the database. However, the user can view details for other organizations by selecting from the Organization drop-down list at the top of the form.

2.4.1 DATA LOGGERS

The left side of the form tracks various data logger equipment items that are in use by each organization. Since a data logger could conceivably be used at more than one site and by different programs over time, each equipment item that might be used by the organization should be listed here. To delete data loggers from the database the user should select the relevant row and use the delete button on the keyboard. **However, the user should be aware that any data that has been uploaded to the database and associated with the deleted equipment item will also be deleted if the equipment item is deleted.**

2.4.2 PROGRAMS

One the top portion of the right side of the form the user can view/provide the names of any monitoring programs for the organization. To delete a program from the database, the user can select the relevant row selector and then press the delete key on the keyboard. **However, be warned that any data associated with that program will also be deleted if the program is deleted.**

The bottom two-thirds of the right side of the form shows program-specific details for whichever programs are currently selected by the user. To view details for a different program, the user can either select the desired program row using the row selector, or click inside the desired program name field.

General information about the program can be stored in the program notes field.

2.4.2.1 Program QAPPS

Program-specific QAPP's, and effective dates, can be added by using the green '+' button that is adjacent to the QAPP header to open the QAPP Details form (Figure 2.8).

Figure 2.8 The *QAPP Detail* form

When the QAPP Detail form opens the user is required to provide a name/version for the QAPP and an effective date. Once these details have been entered, the blue upload and red delete buttons will appear. Finally, the user should click on the blue upload button to attach the QAPP file to the database. The windows explorer navigation dialog box will open and allow the user to navigate to where the word/pdf document containing the QAPP is stored on their network. After the correct file has been selected, the user should click the 'Open' button on the windows explorer dialog to actually attach the file to the database. The database will then make a renamed copy of the file in the QAPPS subfolder.

To view a QAPP the user can click on the small white document button next to the QAPP details on the *Programs and Sites Setup* form. Alternatively, the user can open the *QAPP Details* form by clicking on the white information button, and

then clicking the dark blue document button that will appear in place of the upload button. QAPP details can be edited from the *QAPP Details* form. To delete a QAPP from the database/subfolder, open the *QAPP Details* form and click the large red/white delete (x) button at the bottom left of the form.

2.4.2.2 Program Sites

To add a sampling site to a program the user can select a site from the first unpopulated drop down list on the right side of the *Programs and Sites Setup* form while viewing the relevant program. However, if the site is not present in the drop down list then the user will need to first add the site to the database. To create a new site the user should click on the small green '+' button to the right of the 'Program Sites' header and the *Site Details* form should open (Figure 2.9) to a new/blank record.

Once the form is open, the user should first provide a short and unique site name for the location. The database should automatically input the organization once the name is entered. Finally, a Water Quality classification and the latitude, and longitude must be entered for the site.

Main Menu

Site Details

Site Name:

Site Information

Organization:

Water Quality Class:

General Site Notes:

Spatial Coordinates

Latitude: Longitude:

Decimal Degrees only, WGS NAD83

Figure 2.9 The *Site Details* form

After all of the required details have been entered, the user can save and close the form by clicking the red back-arrow button. If the user wishes to delete the site from the database they can click the red delete (x) button on the bottom left of the form. **However, if the user deletes the site from the database they will also delete any data associated with that site that may have been entered into the database.**

Once the new site has been created, the site name should appear as a selectable item in the Program Sites drop down list and it can be added to the list of sites in the program.

Note that a single site can be added to multiple programs, but it cannot be added more than once to a program.

To view site details about a site, the user can click on the white information button next to the site name while viewing the relevant program. This will re-open the Site Details form. If any data has been uploaded for the site in question, the user will be able to view the downloads, and the specific data for each download, from a new tab that will appear on the site details form.

To return to the main menu the user can click the red/white back-arrow button at the bottom of the *Programs and Sites Setup* form.

2.5 Importing Data

The data stored in the Data Viewer tables are stored in a normalized data structure. However, many files produced by data logger software are stored in a different non-normalized tabular arrangement, usually where there are multiple columns of numerical data for each row.

In addition, different data loggers will collect data for different arrays of variables. For example, weather stations collect meteorological data but not water quality data, while well data loggers record information about various water-related parameters, but not meteorological parameters. And even when the list of parameters is constant, different brands of data logger/sensors may arrange the data differently in their output files, and/or use different units of measurement for the values recorded for the same parameter (e.g., some sensors might record temperature in degrees Fahrenheit instead of degrees Celcius).

To overcome the table structure variability inherent in this situation, a file import tool has been developed to dynamically convert and reconcile the data from its raw format. The import tool can be used to import data from files that contain up to a maximum of 12 columns of data in one table. Currently supported file formats include csv and xls files.

Note: Excel spreadsheets that are to be imported into the Data Viewer must contain only one worksheet. There is currently no mechanism that permits the user to specify the name of a worksheet within a workbook. If you wish to import data that is in a workbook with multiple worksheets, it is necessary to first create a new workbook that contains only the one worksheet that you wish to import.

Selecting the 'Import Data' button on the *Main Menu* form opens the *Import Data* form (Figure 2.10).

Note that during the file import process, the database creates and deletes some temporary tables and queries. This requires that the database be located in a directory where the user has read/write permissions and that the user has exclusive access to the database (i.e., the Data Viewer file is not concurrently opened by other users).

Import Data

(New)

Import a New Data-Logger File into the Database

First, specify the Organization and the Program responsible for the information collected at this site:

OrganizationName: Program and Site:

Note: if the program/site is not listed you will need to add the relevant information using the program setup form (accessible via the main menu) before uploading the file.

Second, specify the Datalogger Used (required) and Spatial Location (optional) of Logger during Deployment:

Logger Used: Deployment Latitude: Decimal Degrees only, WGS NAD 83
Deployment Longitude:

Third, browse to the file that you want to import:

Describe the contents of your file:

Excel Equivalent	Column 1: Col A	Column 2: Col B	Column 3: Col C	Column 4: Col D	Column 5: Col E	Column 6: Col F
Parameter:	<input type="text" value="Do Not Import"/>	<input type="text" value="Do Not Import"/>	<input type="text" value="Do Not Import"/>	<input type="text" value="Do Not Import"/>	<input type="text" value="Do Not Import"/>	<input type="text" value="Do Not Import"/>
Units Used:	<input type="text" value="Nothing"/>	<input type="text" value="Nothing"/>	<input type="text" value="Nothing"/>	<input type="text" value="Nothing"/>	<input type="text" value="Nothing"/>	<input type="text" value="Nothing"/>

Excel Equivalent	Column 7: Col G	Column 8: Col H	Column 9: Col I	Column 10: Col J	Column 11: Col K	Column 12: Col L
Parameter:	<input type="text" value="Do Not Import"/>	<input type="text" value="Do Not Import"/>	<input type="text" value="Do Not Import"/>	<input type="text" value="Do Not Import"/>	<input type="text" value="Do Not Import"/>	<input type="text" value="Do Not Import"/>
Units Used:	<input type="text" value="Nothing"/>	<input type="text" value="Nothing"/>	<input type="text" value="Nothing"/>	<input type="text" value="Nothing"/>	<input type="text" value="Nothing"/>	<input type="text" value="Nothing"/>

Navigation buttons:

Figure 2.10. The *Import Data* form is used to import continuous data from comma delimited text or xls files

2.5.1 Selecting the File to Import

To begin the import process, the user must first specify the organization who collected the data that is to be imported, as well as the program and site where the data was collected, and the name/serial number of the data logger equipment used to collect the data in the file. The user can also optionally elect to provide a latitude and longitude where the datalogger was deployed while collecting the

data. This spatial information for the deployment can be different from the site lat-long if necessary but the location should be considered to be sufficiently close enough that the user is comfortable saying that the data can be merged with other data from the indicated site.

Once these details have been provided, the user selects the blue/white *Browse* button (magnifying glass symbol), which opens the file selection dialog window (Figure 2.11). The dialog window applies a file-type filter that limits selectable files to one of two file formats (xls, csv) that can be accepted by the database. The user can navigate to any directory using the standard windows explorer navigation tools, and they can change which of the file formats to show by using the *Files of Type* drop-down list at the bottom of the window. Once the user has located the file they wish to import they select the *Open* button to continue with the process.

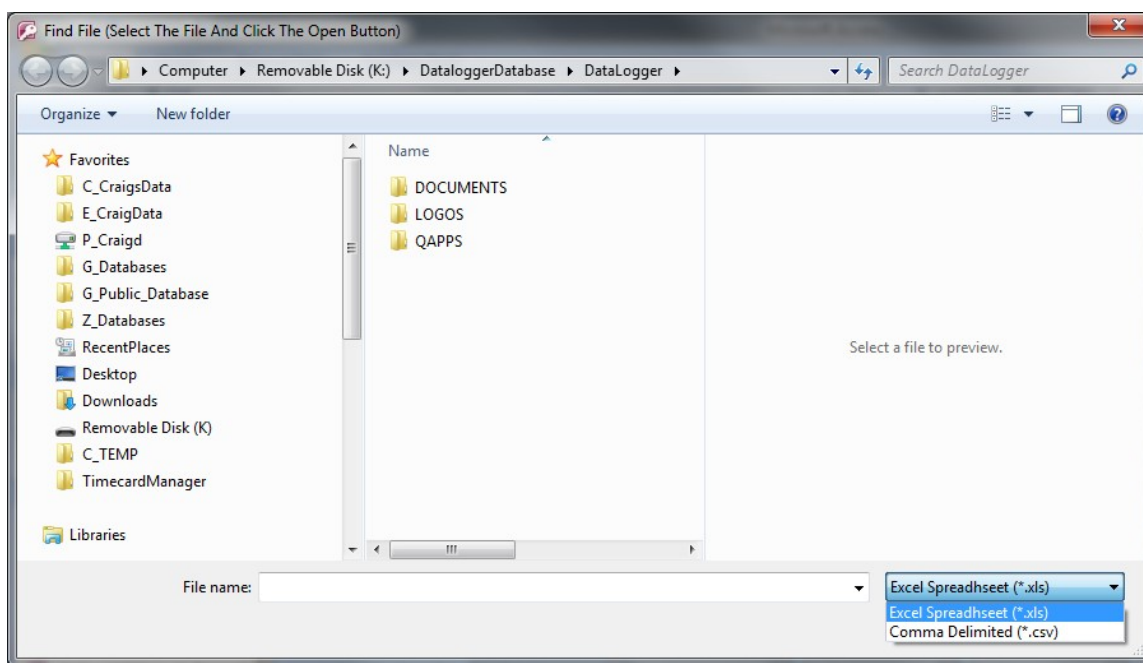


Figure 2.11. The file selection dialog window limits the list of files to formats that can be read by the Data Viewer

2.5.2 Specifying the Import File Contents

In order for the database to correctly import the data inside the selected file, the user is required to specify which columns in the file to be imported contain data that need to be imported, which parameters are present in each of those columns, and which measurement unit is represented by the values in each column.

To assist with this task, the user can select the *View* (excel symbol) button to open the selected file and view the contents. **However, please note that the file preview should be closed before selecting the Upload button because the Data Viewer requires exclusive access to the file during the import process.**

2.5.2.1 Adding a New Parameter type

There is currently no capability for users to add new parameters to the Data Viewer. Please contact the database administrator if this requirement crops up.

2.5.2.2 Adding a New Unit type

There is currently no capability for users to add new units of measurement to the Data Viewer. Please contact the database administrator if this requirement crops up.

2.5.2.3 Example File Import Specification

Figure 2.12 shows the first few rows of an example data file produced by a data logger that could be imported into the LCDMS.

	A	B	C	D	E	F	G	H	I	J
1	Serial Number									
2	1048615									
3	Project ID									
4	Smuggler's Slough Tidegate Study									
5	Location									
6	SW059									
7	Water Level									
8	Unit									
9	ft									
10	Offset									
11	0.00	ft								
12	Altitude									
13	4	ft								
14	Temperature									
15	Unit									
16	Deg C									
17	Spec. Cond.									
18	Unit									
19	µS/cm									
20	Temp. Coefficient									
21	2.000000									
22		Date	Time	Water Level	Temperature	Spec. Cond.				
23	1	6/10/2010	0:00:00	2.4921	15.418	1488.4				
24	2	6/10/2010	0:10:00	2.4812	15.344	1490.58				
25	3	6/10/2010	0:20:00	2.4939	15.355	1489.12				
26	4	6/10/2010	0:30:00	2.4889	15.335	1489.34				
27	5	6/10/2010	0:40:00	2.494	15.313	1490.16				
28	6	6/10/2010	0:50:00	2.503	15.296	1490.24				
29	7	6/10/2010	1:00:00	2.4959	15.278	1491.45				

Figure 2.12. A sample CSV file to be imported into the Data Viewer, displayed in Excel

This file begins with 21 rows of metadata that are ignored during the import process. The 22nd row contains column header descriptions that are also ignored during the import process because different data loggers may use different labels for the same parameter.

The remaining rows in the file contain numerical values in the first six columns.

The first column in this example contains a meaningless row identification number that should be ignored. Accordingly, the user should ensure that 'Do Not Import' is selected in the *Parameter* drop-down list for *Column 1/Excel A*.

The second and third columns in the file contain the calendar date and the time at which the values in the remaining columns were recorded. Accordingly, for this

example, the user should ensure that 'Date Only' is the selected parameter for *Column 2/Excel B*, and that 'Time Only' is the selected parameter for *Column 3/Excel C*. However, if the data and time values were combined into one column, then the user would need to select the 'Date/Time' parameter option instead.

Note that both date and time values are required elements for importing continuous data. In the case of average daily temperature data obtained from online sources, only a date may be available. In such a case, the user may elect to also provide a 'Time Only' column indicating the time of day that should be assumed for each observation, or else select the 'Date/Time' parameter option for the column containing only dates. In the latter scenario, the time will be assumed to be midnight at the start of that calendar day.

The final three columns contain values representing Water Level, Water Temperature, and Specific Conductivity respectively. Accordingly, the user should select the matching parameters from the drop-down list for each corresponding column. (For this example, the 'Water Level – Relative' parameter option will be used to import this data).

Caution: 'Water Level' versus 'Water Level – Relative' parameter confusion

There are different water level options in the drop down list: 'Water Level (*datum name*)' and 'Water Level – Relative'. The 'Water Level (*datum name*)' options are for values where the absolute elevation of the water surface is to be calculated and compared to a recognized vertical datum, such as Mean Sea Level (MSL) or NAVD88. The 'Water Level – Relative' option is for water level values that are not corrected to any objective vertical datum and can only be compared to other values from the same source file. **The two MSL options are intended for use with well monitoring data and should not be used for surface water monitoring data as use of these will trigger additional data requirements that will not apply to surface water.**

If the user selects the 'Water Level (MSL) - Pumping' or 'Water Level (MSL) – Not pumping' options, then the file import tool will require some additional information to perform the necessary calculations and a new data element will appear on the form (Figure 2.13).



Vertical Distance from MSL to Water Level Sensor (decimal feet only):

Figure 2.13. Mean Sea Level water levels require additional information to be provided to the Data Viewer

Because most water level sensors measure pressure and then calculate the depth of water above the sensor, it is necessary to determine the absolute elevation of the sensor in order to determine the absolute elevation of the water surface above it. If the user knows the absolute elevation of the sensor, then they can input this value into the *Vertical Distance* field directly (the measurement units for this value must be in decimal feet or the conversion will be inaccurate). If the user has not calculated this value, a small elevation calculator tool can be opened using the

Calc button (Figure 2.14). If the user can supply all the supplementary information the calculator will determine the sensor elevation value and input the final value into the import tool.

The screenshot shows a dialog box titled "fmCalcElevation : Form". It contains the following text and input fields:

- "The ground elevation at the well is feet above MSL."
- "The measuring point is feet the ground surface."
- "The sensor was feet below the measuring point."
- "The sensor was: feet above MSL."

At the bottom right, there are two buttons: "Done" and "Cancel".

Figure 2.14. The sensor elevation calculation tool

After the user selects the parameter for each column that needs to be imported, a default unit or format for that parameter is shown in the associated *Units Used* drop-down list. If the default formats or units for that parameter do not match the data in the file, then the user should pick the format or unit that accurately matches the data in the file. This allows the database to convert the values to the default units for storage and ensures that all database outputs consistently use the same unit of measurement for each parameter even if various source files use different units of measurement for the same parameter. Additionally, the user should note that, with the exception of the QA Code field, if any of the cells contain text, or are empty, then the values in those cells would not be imported into the Data Viewer.

The remaining columns in the import file do not contain any values and the user should therefore ensure that the parameter drop-down list for any surplus columns is set to 'Do Not Import'. Figure 2.15 shows the completed import specification for the file shown in Figure 2.12.

Import Data

29

Import a New Data-Logger File into the Database

First, specify the Organization and the Program responsible for the information collected at this site:

OrganizationName: Lummi Water Resources
 Program and Site: test site (Ambient Water Quality Monitoring Progr)

Note: If the program/site is not listed you will need to add the relevant information using the program setup form (accessible via the main menu) before uploading the file.

Second, specify the Datalogger Used (required) and Spatial Location (optional) of Logger during Deployment:

Logger Used: 101023423-A
 Deployment Latitude:
 Deployment Longitude:
 Decimal Degrees only. WGS NAD 83

Third, browse to the file that you want to import:

K:\DataloggerDatabase\ImportFiles\example.xls

Describe the contents of your file:

Excel Equivalent	Column 1: Col A	Column 2: Col B	Column 3: Col C	Column 4: Col D	Column 5: Col E	Column 6: Col F
Parameter:	Do Not Import	Date Only	Time Only	Water Level - R	Specific Conduct	Do Not Import
Units Used:	Nothing	MM/DD/YY	HH:MM AM/PM	Feet	µS/cm	Nothing

Excel Equivalent	Column 7: Col G	Column 8: Col H	Column 9: Col I	Column 10: Col J	Column 11: Col K	Column 12: Col L
Parameter:	Do Not Import	Do Not Import	Do Not Import	Do Not Import	Do Not Import	Do Not Import
Units Used:	Nothing	Nothing	Nothing	Nothing	Nothing	Nothing

Upload (blue/white up-arrow symbol) and Back (red/white left-arrow symbol) buttons.

Figure 2.15. The example import file contents, formats, and units have been specified by the user

2.5.3 Importing the Data

Once all of the required information has been provided by the user, then the user can begin the actual data import process by selecting the 'Upload' (blue/white up-arrow symbol) button.

Once the user has clicked the button, the Data Viewer will attempt to verify that the user has provided all of the required information. Note that the Data Viewer has no ability to determine if the specifications supplied by the user are accurate. It is the responsibility of the user to ensure that the column specifications are correct and match up exactly with the column numbers/letters when the source file is viewed in Excel. If you tell it that Column C is water temperature and it is actually specific conductivity then it will believe you!

During the process of transferring data values from the source file to a temporary table in the database, the values are each checked to ensure that they both exist and are numerical. Null/empty cells, and values in cells that also contain text entries (letters) will not be imported into the temporary table. Any rows that contain nulls/empty cells in the date/time field(s) will be removed from the temporary table and not stored in the database.

The QA code field will be imported into a different field which is limited to one letter. There can only be one QA Code column/field per file, and this column can only contain a single one-digit letter code per cell.

Once the data have been relocated to the temporary table, the values in each of the *Parameter* columns are paired with the relevant date/time value and transferred to the normalized *Observations* table for permanent storage.

As the values are being transferred from the temporary table to the *Observations* table, the units are checked to ensure they match the default units for that parameter. If the units do not match, the values are converted to the default unit of measurement using the custom VBA function *unitconvert*, which is located in the public code module *modFunctions*. (Additionally, any values for the 'Water Level (MSL)' parameter are converted from measurements of 'depth of water above the sensor' into absolute water surface elevations using the user-supplied sensor elevation value that is required for importing this parameter.)

During the transfer of data into the *Observations* table, the database checks to see if there is any temporal overlap between the data that is already present in the *Observations* table, and the new data that is being imported. If there is an overlap with pre-existing, the user will be required to specify how the database should handle this duplication.

When prompted with an overlap situation, the user may elect to:

- Overwrite old data with the new data if there is duplicate information (Select 'Yes')
- Keep old data and not import duplicated information (Select 'No')
- Cancel importing any data from the file (Select 'Cancel')

Once the data has been successfully imported, the database will provide a popup dialog box announcing that the import is 'Done'. The file import process may take several minutes, depending on how much data is present in the source file. Note that the import process can be slowed down massively when an overlap situation is encountered. It is highly recommended to ensure that new data does not overlap with existing data if at all possible.

Once the user has selected the Ok button in the 'Done' dialog, they can return to the *Main Menu* by clicking the red back-arrow button on the *Import Data* form.

2.6 Export Raw/Summary Data to Excel

The Data Viewer provides a data export tool that allows users to extract raw data observations as a CSV file from the stored data, or else to export summary statistic tables and graphs that describe the stored data using time intervals that are specified by the user. In addition, an alternate export functionality can be used to analyze a hybrid statistic that is a '7-day average of daily maximum value' (7DADM) versus regulatory control limits that reference this metric.

To make use of these export tools, the user can select the *Export Data* button on the main menu to open the *Export Data* form (Figure 2.16).

Export Data

Choose Data

Select Location and Program

Site	OrganizationName	ProgramName	WaterQualityClass
test site	Lummi Water Resources	Ambient Water Quality Monitoring Program	Ephemeral Class AA

Limit Source To: **Lummi**

Select Parameter(s): Temperature (Water)

Select Date Range to Export:

Start Date: 03/12/2012 2:00 PM

End Date: 03/13/2012 11:30 PM

Output Options

☐ Raw Data (exports to CSV only)

☒ Export Summary Table and Graphs (Excel) Summarize Data using an interval of: 7 day(s)

Statistic Columns to Include in Table: ☒ All

Arithmetic Mean
Standard Deviation
Count of Observations
Maximum Value
Minimum Value

Control Limit Columns to Include in Table: ☒ All

Select Graphs to Include: ☒ All

Output Options for Graphs:

Choose Graph Type: ☒ Each selected statistic plotted on separate graphs
☐ All Selected Statistics plotted together on one graph

Display Statistic/Data Series as: ☒ Lines ☒ Columns/Bars ☐ Areas

Display Control Limits as: ☒ Lines ☐ Columns/Bars ☐ Areas

Note that if you have selected more than one site, the observations will be pooled before the summary statistics are calculated.

7DADM Limit Override (deg.C): (Optional)

7DADM

7DADM Limit Override (deg.C): (Optional)

Figure 2.16. The *Export Data* form is used to export data from the Data Viewer to other file formats

2.6.1 Choosing Data to Export Using Location, Program, Parameters, and Dates

Before any data can be exported, the user is required to specify the Location and Program from which the data is wanted. Once the user selects a location and program, the form will be updated to show the date range for which data is available from that location, and to show the list of parameters for which data are available at that location (e.g., Figure 2.16 shows that data from the location 'testsite' and collected under the program 'Ambient WQ Monitoring Program' has been selected for export). The user may optionally elect to view more details (e.g., lat long, location notes etc) about the selected location by clicking the 'View Location Details' button. Note that the user can select more than one location/program to export but only if the selected sites all share the same water quality classification. When multiple sites/programs are selected the data for all will be pooled as if they were one site.

The user is then required to specify which of the available parameters should be exported. In this example, only one parameter is available (Water Temperature). However, if multiple parameters are available then the user can choose one or more parameters to export.

The user can also elect to narrow down the date range to a subset of the available data if so desired.

2.6.2 Choosing the Desired Output Option

Once the location(s), date range, and parameters have been specified, the user can proceed to specify whether they wish to export 'raw' data (i.e., individual observations with an accompanying timestamp in a tabular format), or whether they wish to export tables and/or graphs of summary statistics for each parameter, using a user-specified time interval to group the raw data.

2.6.2.1 Raw Data (CSV) Export

To export 'raw data' values from the Data Viewer, the user should first select the *Raw Data* option box, and then select the 'Export Data' (green/white down-arrow symbol) button to begin the export process. This option creates a comma delimited text file (CSV) that contains the requested data. **Note that this export feature has only been tested when **ONLY ONE SITE** has been selected. It is not recommended to try this option after selecting multiple sites.**

The data in the resulting CSV file is de-normalized and contains one row with column descriptions, followed by a row for each date/time when a measurement was recorded at the location. The first column contains the location identifier. The second column contains the observation date and time. The last column contains any applicable QA codes that may or may not have been included when the file was imported. If no QA code was imported then this column will be blank. The remaining columns contain the recorded data values; with each column representing a different parameter. The column descriptions indicate the parameter name and units contained in that column.

2.6.2.2 Summary Tables and Graphs Export

The other export option creates an excel spreadsheet file that contains one or more summary statistics of the data for the selected parameters. Additionally, the user may specify that a variety of charts be automatically created in the same file.

Summary Statistic Time Intervals

The Data Viewer export function can calculate simple summary statistics for the requested data using a user-specified time interval. To set the interval the user must provide a numerical frequency and a time unit from the interval drop-down list.

For example, if the user specifies a time interval of '7-days' then the summary statistics will be calculated using data grouped into intervals that each last for 7 days. If the user chooses an interval of '1 month', the summary statistics will be

calculated on a monthly basis. Likewise, an interval of ‘1-Day’ would generate summary statistics calculated on a daily basis.

Summary Tables

The export process builds a separate table of summary statistics for each of the selected parameters, and exports them as separate worksheets within the Excel file. Each of these worksheets is named using the corresponding parameter appellation. The tables are comprised of rows that correspond to the user-defined time intervals that were calculated during the selected export date range. The left-most columns provide the location name, the parameter id and name, the interval start date/time, end date/time, and mid-point date/time, and the units of measurement used. One column is then appended for each of the statistics that the user selected from the *Statistic Columns to Include in Table* list ().

	A	B	C	D	E	F	G	H	I	J
1	ObservationPlaceName	ObservationTypeID	ObservationType	FirstObs	MidPeriod	LastObs	Unit	AvgOfObservationValue	MaxOfObservationValue	MinOfObservationValue
2	South Fork	20	Temperature (Water)	7/19/2001	7/25/2001	7/31/2001	deg C	15.43076926	17.20000076	13.5
3	South Fork	20	Temperature (Water)	8/1/2001	8/16/2001	8/31/2001	deg C	15.83548386	18.89999962	11.69999981
4	South Fork	20	Temperature (Water)	9/1/2001	9/15/2001	9/30/2001	deg C	13.05333328	15	10
5	South Fork	20	Temperature (Water)	10/1/2001	10/16/2001	10/31/2001	deg C	7.880645183	11.60000038	5.300000191
6	South Fork	20	Temperature (Water)	11/1/2001	11/15/2001	11/30/2001	deg C	5.943333324	7.900000095	4.099999905
7	South Fork	20	Temperature (Water)	12/1/2001	12/16/2001	12/31/2001	deg C	3.574193543	4.800000191	1.600000024
8	South Fork	20	Temperature (Water)	1/1/2002	1/16/2002	1/31/2002	deg C	3.30322579	5	1
9	South Fork	20	Temperature (Water)	2/1/2002	2/14/2002	2/28/2002	deg C	3.332142881	4.300000191	2.200000048
10	South Fork	20	Temperature (Water)	3/1/2002	3/16/2002	3/31/2002	deg C	3.093548363	5.199999809	0.899999976
11	South Fork	20	Temperature (Water)	4/1/2002	4/15/2002	4/30/2002	deg C	5.331034471	7.699999809	3.799999952
12	South Fork	20	Temperature (Water)	5/1/2002	5/16/2002	5/31/2002	deg C	6.312903189	8.5	4.599999905
13	South Fork	20	Temperature (Water)	6/1/2002	6/15/2002	6/30/2002	deg C	8.626666625	11.10000038	6.400000095
14	South Fork	20	Temperature (Water)	7/1/2002	7/16/2002	7/31/2002	deg C	13.53000005	17.10000038	9.5
15	South Fork	20	Temperature (Water)	8/1/2002	8/16/2002	8/31/2002	deg C	15.73870967	17.70000076	12.39999962
16	South Fork	20	Temperature (Water)	9/1/2002	9/15/2002	9/30/2002	deg C	12.99666659	16.10000038	10.5
17	South Fork	20	Temperature (Water)	10/1/2002	10/16/2002	10/31/2002	deg C	8.593548313	11.39999962	2.700000048
18	South Fork	20	Temperature (Water)	11/1/2002	11/15/2002	11/30/2002	deg C	5.696666654	8.300000191	2
19	South Fork	20	Temperature (Water)	12/1/2002	12/16/2002	12/31/2002	deg C	4.419354823	6.099999905	2.400000095
20	South Fork	20	Temperature (Water)	1/1/2003	1/16/2003	1/31/2003	deg C	4.516128994	6	2.5
21	South Fork	20	Temperature (Water)	2/1/2003	2/14/2003	2/28/2003	deg C	3.699999998	5.300000191	2.099999905
22	South Fork	20	Temperature (Water)	3/1/2003	3/16/2003	3/31/2003	deg C	4.551612885	6.300000191	2.900000095
23	South Fork	20	Temperature (Water)	4/1/2003	4/15/2003	4/30/2003	deg C	6.060000038	8.100000381	4.199999809
24	South Fork	20	Temperature (Water)	5/1/2003	5/16/2003	5/31/2003	deg C	8.348387164	10.39999962	6.300000191
25	South Fork	20	Temperature (Water)	6/1/2003	6/15/2003	6/30/2003	deg C	12.32666664	16.20000076	9
26	South Fork	20	Temperature (Water)	7/1/2003	7/16/2003	7/31/2003	deg C	17.22580654	21	12.80000019
27	South Fork	20	Temperature (Water)	8/1/2003	8/16/2003	8/31/2003	deg C	17.56451613	19.29999924	15.5
28	South Fork	20	Temperature (Water)	9/1/2003	9/15/2003	9/30/2003	deg C	13.99999994	17.39999962	11.10000038
29	South Fork	20	Temperature (Water)	10/1/2003	10/16/2003	10/31/2003	deg C	9.845161346	13.69999981	3.900000095
30	South Fork	20	Temperature (Water)	11/1/2003	11/15/2003	11/30/2003	deg C	4.093333328	5.900000095	1.399999976
31	South Fork	20	Temperature (Water)	12/1/2003	12/16/2003	12/31/2003	deg C	3.822580637	5.400000095	0.800000012
32	South Fork	20	Temperature (Water)	1/1/2004	1/16/2004	1/31/2004	deg C	3.780769197	5.099999905	1.5
33	South Fork	20	Temperature (Water)	2/1/2004	2/15/2004	2/29/2004	deg C	4.120689672	5.5	3
34	South Fork	20	Temperature (Water)	3/1/2004	3/16/2004	3/31/2004	deg C	5.006451607	7	3.599999905
35	South Fork	20	Temperature (Water)	4/1/2004	4/15/2004	4/30/2004	deg C	7.286666679	9.300000191	5
36	South Fork	20	Temperature (Water)	5/1/2004	5/16/2004	5/31/2004	deg C	8.454838691	10.69999981	7.199999809
37	South Fork	20	Temperature (Water)	6/1/2004	6/15/2004	6/30/2004	deg C	11.96999995	15.80000019	8.5

Figure 2.17. Example table output showing three summary statistic data columns for the water temperature parameter at the ‘South Fork’ location

Finally, if there are any regulatory control limits that apply to the WQ classification of the site and the selected parameters/statistics, then these will appear in the *Control Limits to Export to Table* list. A column for each selected

control limit will be appended to the right of the exported summary table specific to the appropriate parameter.

Summary Statistic Charts

The export tool can automatically generate charts within the Excel file that are based on the exported summary tables. However, it must be noted that the option to export particular charts is unavailable unless the corresponding table data columns have already been selected for export. For example, there is no option to generate a chart showing the arithmetic mean for water temperature unless both the water temperature parameter and the arithmetic mean statistic have been selected for export to the summary table. However, once these have been selected, the 'Arithmetic Mean' option will appear in the *Select Graphs to Include* list and the user may optionally select this option to cause the export process to generate the chart. Similarly, if the user has selected any control limits to be exported to the summary table, these will become available in the *Control Limits to Include in Graphs* list for addition to the applicable charts that have been selected by the user.

There are also a number of chart formatting options that can be configured by the user prior to export. Once the excel file is created, the user is also free to modify the charts using the standard editing and formatting options that are available within the spreadsheet software.

Graph Types

Graph type determines whether each statistic will be presented on separate charts (Figure 2.18), or whether all of the selected statistics will be presented together on just one chart (Figure 2.19). For example, if there are three selected statistics to be graphed for each selected parameter, the former option will result in three charts per selected parameter, while the latter option will result in one chart per selected parameter.

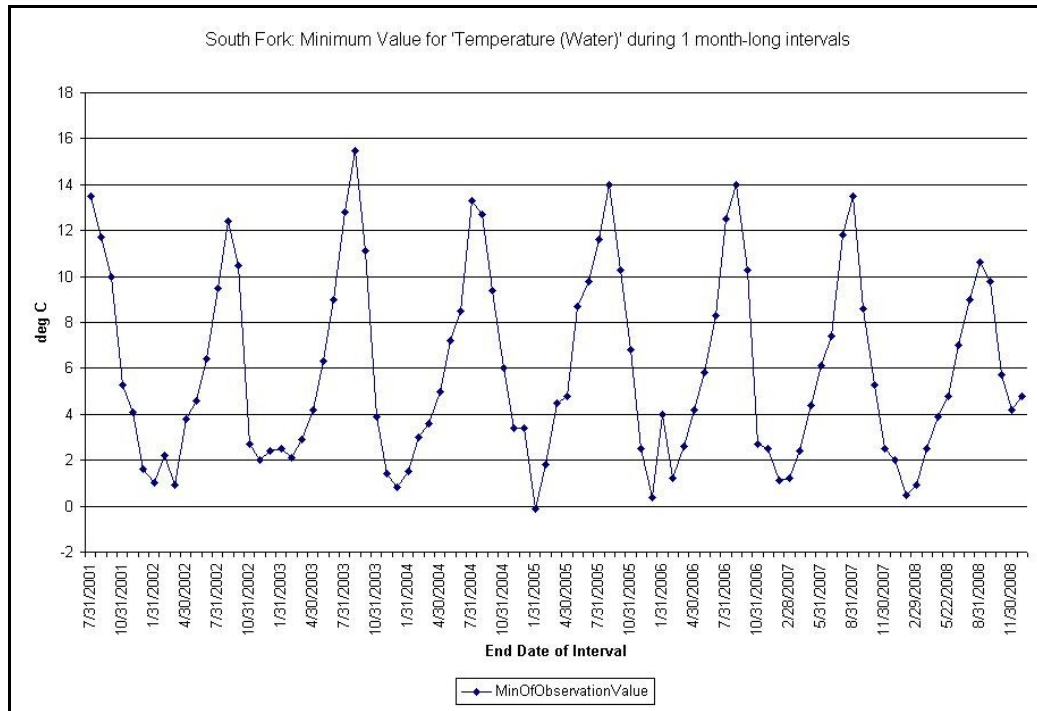


Figure 2.18. Example of a line chart export with only one statistic per chart

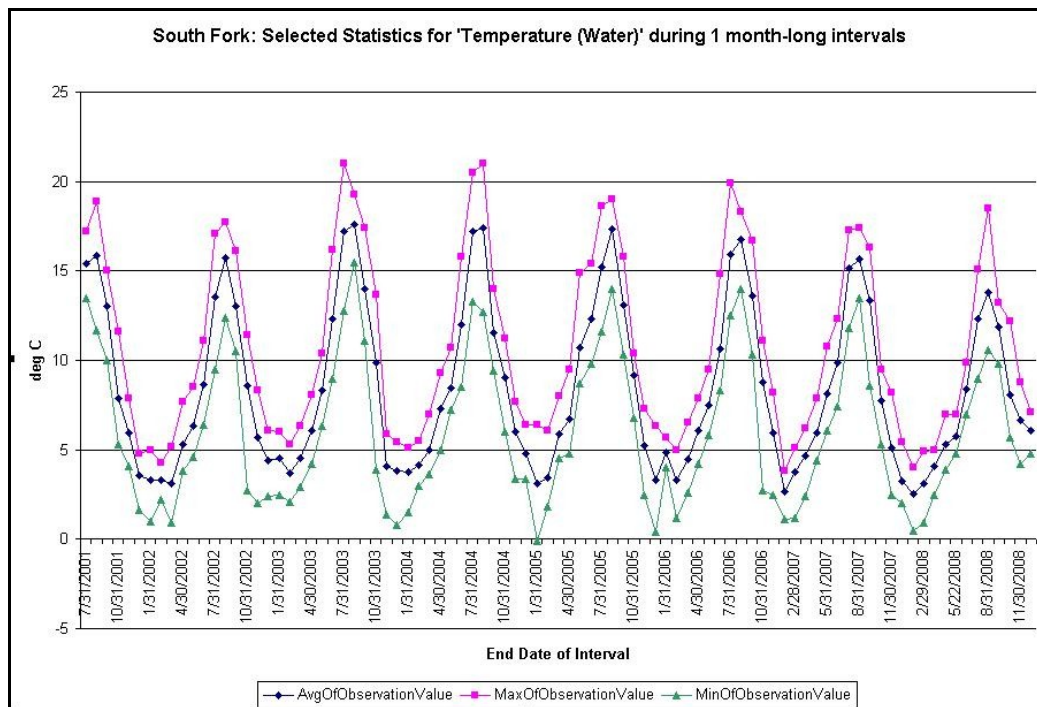


Figure 2.19. Example of a line chart export with multiple statistics on one chart

Summary Statistic Data Series Formats

The export tool allows the user to determine whether the data series that correspond to summary statistics are displayed as lines (e.g., Figure 2.19), columns (e.g., Figure 2.20), or areas (e.g. Figure 2.21). The default setting for data series is to display them as columns.

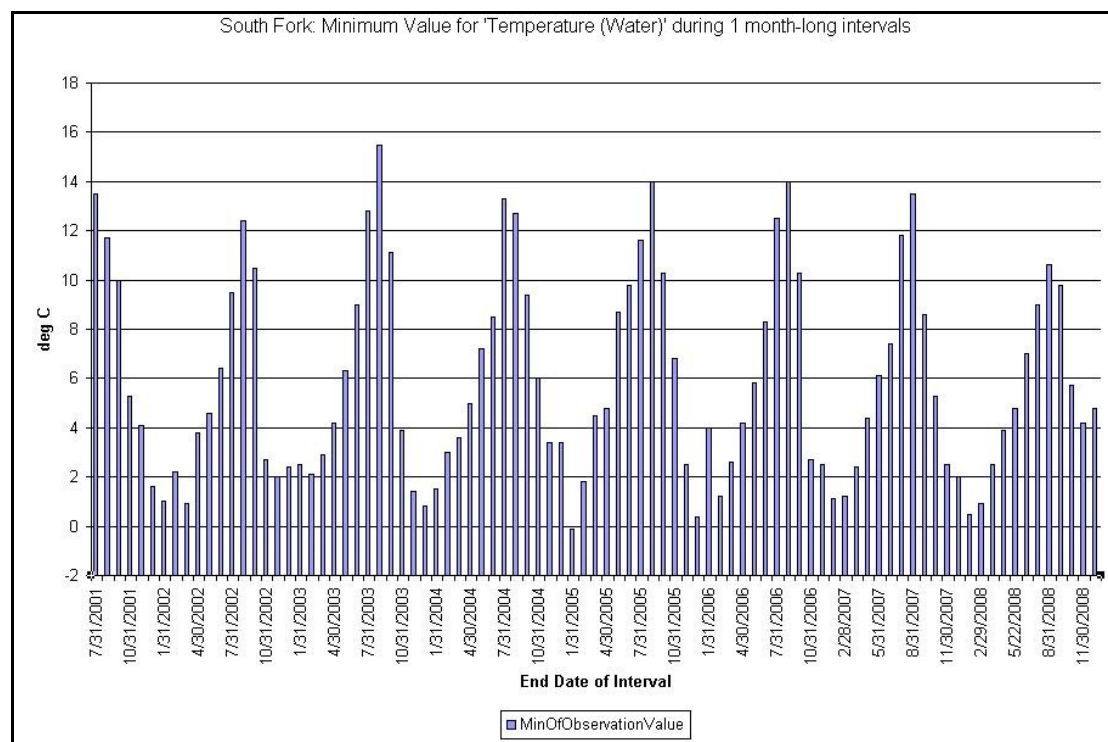


Figure 2.20. Example of a column chart export with one summary statistic data series

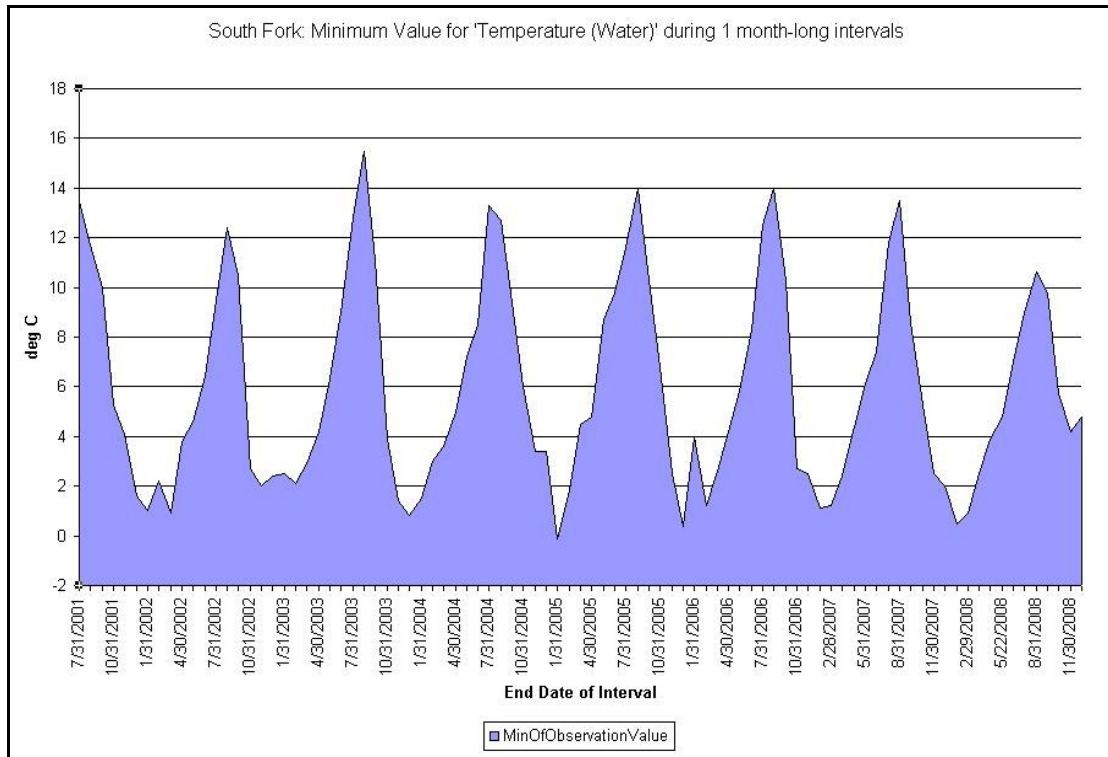


Figure 2.21. Example of an area chart export with one summary statistic data series

Control Limit Data Series Formats

The data export tool allows the user to specify how any selected control limit data series should be displayed on the charts. As with the summary statistic data series, the available options are to display control limits as lines, columns, or areas. The default option is to display control limits as lines.

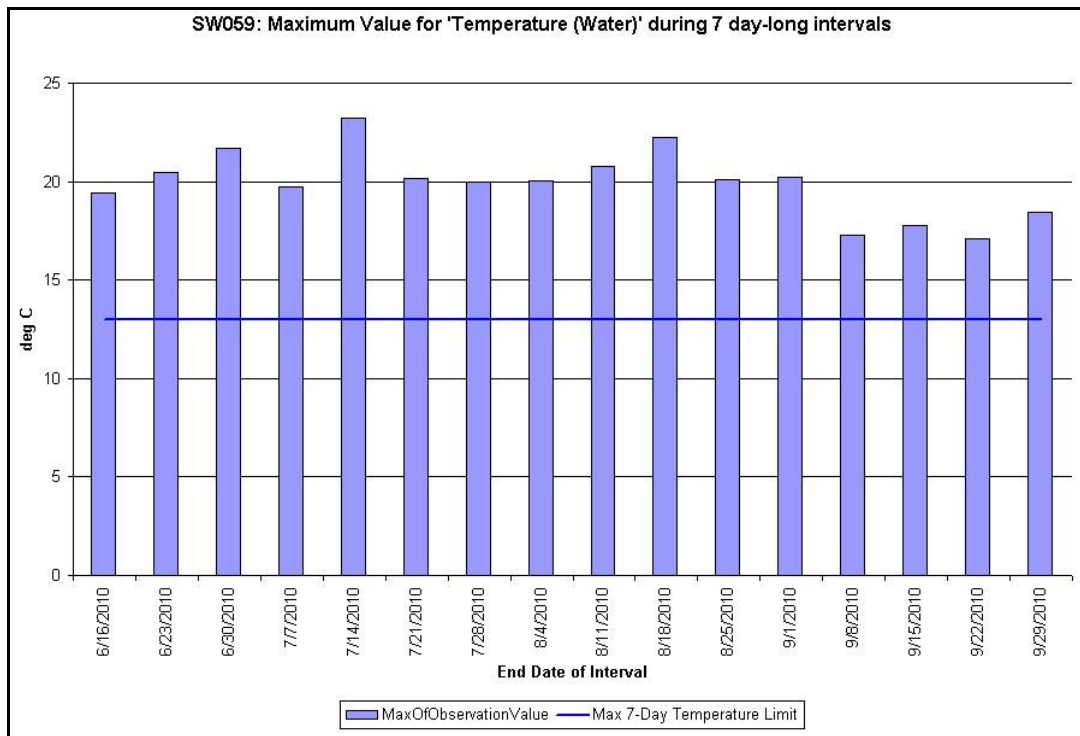


Figure 2.22. The default format for an exported chart uses columns for data series and lines for the control limit series

2.6.2.3 Export 7DADM Data to Excel

One of the water quality standards used to evaluate temperatures of surface water bodies uses a compound statistic called the 7-day average daily maximum (7DADM) temperature. This statistic involves firstly calculating the maximum daily temperature for each calendar date, then obtaining a moving average of those daily maximums using an averaging period of seven days.

The Data Viewer derive this compound statistic for a selected site, and then exports the summary data to a Microsoft Excel spreadsheet, and also inserts a chart of the data into the created file.

When the user selects a site and program from the list, the database automatically updates the date range to reflect the available range of dates for the site, and displays the 7DADM control limit (if any) that is applicable to the site. If the user wishes to over-ride this control limit value prior to export, then this limit value can be edited.

Once the user has specified the site, desired date range, and control limit value, the user clicks the blue '7DADM' button to begin the export process. Note: because the 7DADM requires a full seven days of maximum values, the first and last three dates of each continuous sampling block during the period of record will not have a corresponding 7DADM value. This can lead to gaps in the output time series (Figure 2.23).

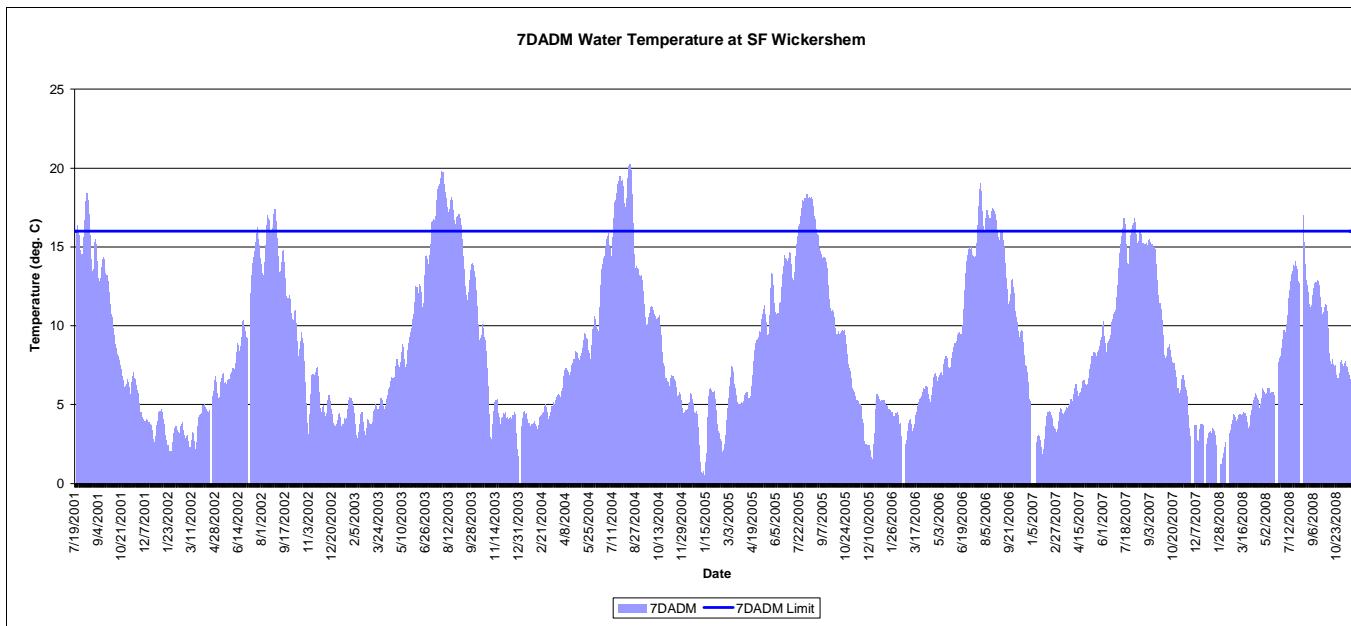


Figure 2.23. Example Showing the 7DADM Chart Output for the South Fork Wickershem Gage Station

2.7 Open User Guide

The user can open the most recent version of this document by selecting the green 'User Guide' button from the *Main Menu* form. Alternatively, the user guide can be accessed by going to the following url <http://Innr.lummi-nsn.gov/LummiWebsite/Website.php?PageID=301> and clicking the indicated link.

3 Sharing Information with another Tribe

The process of sharing data requires each tribe to make a copy of the sharing tribe's Tables file, and a copy of the QAPP's folder that is located in the same directory as the Data Viewer file.

For example:

Lummi stores its DataViewer file and Tables files in the network folder:

G:\Natural Resources\Databases\DataLoggerData\

If Lummi wanted to share their data with Nooksack they would provide Nooksack with an up-to-date copy of the file:

G:\Natural Resources\Databases\DataLoggerData\Lummi_DataloggerData_Tables.accdb,

and also a copy of the QAPPS folder with all its contents:

G:\Natural Resources\Databases\DataLoggerData\QAPPS

Nooksack would then replace their old copy of the Lummi_DataloggerData_Tables.accdb file with the newly shared copy, and copy the contents of the new QAPP folder and paste them into Nooksack's copy of the QAPP folder. This step is necessary to ensure that links to Lummi QAPP's that are present in the Lummi tables file can work to correctly open the attached files.

There is no requirement for sharing data stored in the US_DataloggerData_Tables.accdb file.

4 Getting Data Viewer Updates

The most recent copy of the Data Viewer file can be obtained at the following url:

<http://Innr.lummi-nsn.gov/LummiWebsite/Website.php?PageID=301>

Download the file and overwrite the old copy in your permanent network location folder. Note that you will be prompted to re-link the table files for each data source when you first choose to view data from that source.